

Attendance Problems**Simplify.**

1. $7 - (-3)$

2. $-1 - (-13)$

3. $|-7 - 1|$

Solve each equation.

4. $2x + 3 = 9x - 11$

5. $3x = 4x - 5$

6. How many numbers are there between $\frac{1}{2}$ and $\frac{3}{4}$?

Vocabulary		
coordinate	midpoint	distance
bisect	length	segment bisector
construction	between	congruent segments

- I can use length and midpoint of a segment.
- I can construct midpoints and congruent segments.

Common Core: CC.9-12.G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometry software, etc.).

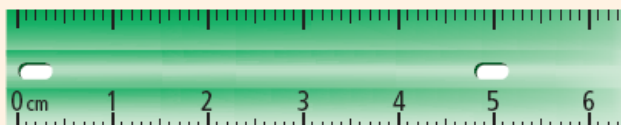
Carpenter 1: Why did you leave your tape measure in the truck?

Carpenter 2: Because we're entering a construction zone.

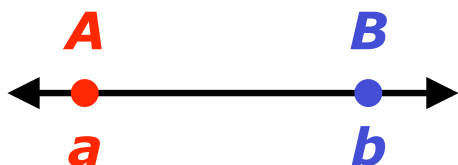
A ruler can be used to measure the distance between two points. A point corresponds to one and only one number on a ruler. The number is called a **coordinate**. The following postulate summarizes this concept.

Postulate 1-2-1 **Ruler Postulate**

The points on a line can be put into a one-to-one correspondence with the real numbers.



The **distance** between any two points is the absolute value of the difference of the coordinates. If the coordinates of points A and B are a and b , then the distance between A and B is $|a - b|$ or $|b - a|$. The distance between A and B is also called the **length** of \overline{AB} , or AB .



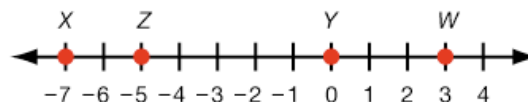
$$AB = |a - b| \text{ or } |b - a|$$

If you permit yourself to read meanings into (rather than drawing meanings out of) the evidence, you can draw any conclusion you like. -- Michael Keith, "The Barcode Beast", *The Skeptical Enquirer* Vol 12 No 4 p 416

Video Example 1. Find each length

A. WY.

B. XW

**1 Finding the Length of a Segment**

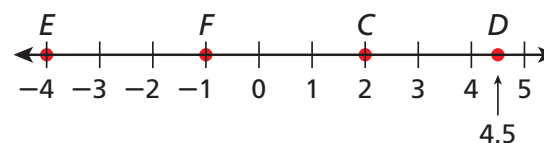
Find each length.

A DC

$$\begin{aligned} DC &= |4.5 - 2| \\ &= |2.5| \\ &= 2.5 \end{aligned}$$

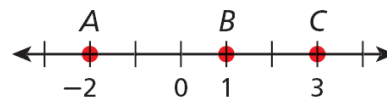
B EF

$$\begin{aligned} EF &= |-4 - (-1)| \\ &= |-4 + 1| \\ &= |-3| \\ &= 3 \end{aligned}$$

**Example 1. Find each length**

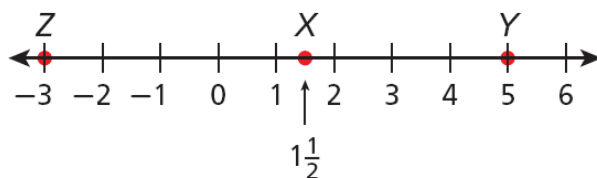
A. BC

B. AC

**Guided Practice. Find each length.**

7. XY

8. XZ



9. What are congruent segments?

10. What is the symbol for congruent?

11. In a diagram, how do you show two segments are congruent?

You can make a sketch or measure and draw a segment. These may not be exact. A **construction** is a way of creating a figure that is more precise. One way to make a geometric construction is to use a compass and straightedge.



Construction Congruent Segment

Construct a segment congruent to \overline{AB} .

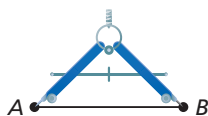


1



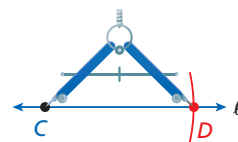
Draw ℓ . Choose a point on ℓ and label it C .

2



Open the compass to distance AB .

3



Place the point of the compass at C and make an arc through ℓ . Find the point where the arc and ℓ intersect and label it D .

$$\overline{CD} \cong \overline{AB}$$

Video Example 2: Construct a segment congruent to \overline{PQ} .



2**Copying a Segment**

Sketch, draw, and construct a segment congruent to \overline{MN} .

Step 1 Estimate and sketch.

Estimate the length of \overline{MN} and sketch \overline{PQ} approximately the same length.

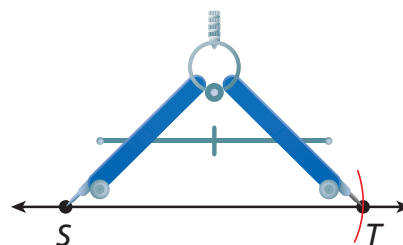
Step 2 Measure and draw.

Use a ruler to measure \overline{MN} . MN appears to be 3.1 cm. Use a ruler and draw \overline{XY} to have length 3.1 cm.

Step 3 Construct and compare.

Use a compass and straightedge to construct \overline{ST} congruent to \overline{MN} .

A ruler shows that \overline{PQ} and \overline{XY} are approximately the same length as \overline{MN} , but \overline{ST} is precisely the same length.



Example 2: Sketch, draw, and construct a segment congruent to \overline{MN} .



12. Guided Practice. Sketch, draw, and construct a segment congruent to \overline{JK} .



1-2 Measuring and Constructing Segments: (p 17) 11-15.

In order for you to say that a point B is **between** two points A and C , all three points must lie on the same line, and $AB + BC = AC$.

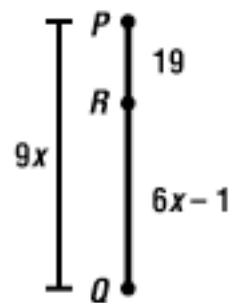
Postulate 1-2-2 Segment Addition Postulate

If B is between A and C ,
then $AB + BC = AC$.

**Video Example 3.**

A. Suppose that A , B , and C are collinear points. B is between A and C , $AC = 25$, and $BC = 7.2$. Find AB .

B. Find PQ .



3 Using the Segment Addition Postulate

A B is between A and C , $AC = 14$, and $BC = 11.4$. Find AB .

$$AC = AB + BC$$

$$14 = AB + 11.4$$

$$\begin{array}{r} - 11.4 \\ 14 = AB + 11.4 \\ \hline 2.6 = AB \end{array}$$

Seg. Add. Post.

Substitute 14 for AC and 11.4 for BC .

Subtract 11.4 from both sides.

Simplify.

B S is between R and T . Find RT .

$$RT = RS + ST$$

$$4x = (2x + 7) + 28$$

$$4x = 2x + 35$$

$$\begin{array}{r} - 2x \\ 4x = 2x + 35 \\ \hline 2x = 35 \end{array}$$

$$\frac{2x}{2} = \frac{35}{2}$$

$$x = \frac{35}{2}, \text{ or } 17.5$$

$$RT = 4x$$

$$= 4(17.5) = 70$$

Seg. Add. Post.

Substitute the given values.

Simplify.

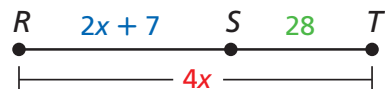
Subtract $2x$ from both sides.

Simplify.

Divide both sides by 2.

Simplify.

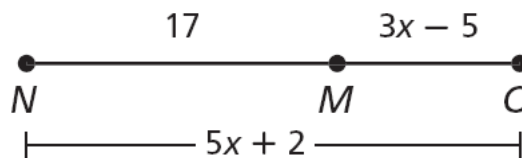
Substitute 17.5 for x .



Example 3.

A. G is between F and H , $FG = 6$, and $FH = 11$. Find GH .

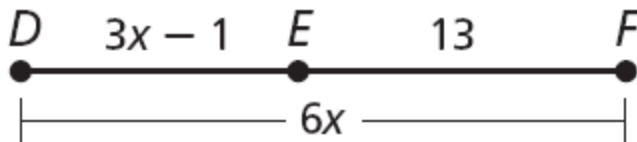
B. M is between N and O . Find NO .



Guided Practice.

13. Y is between X and Z , $XZ = 3$, and $XY = 1\frac{1}{3}$. Find YZ .

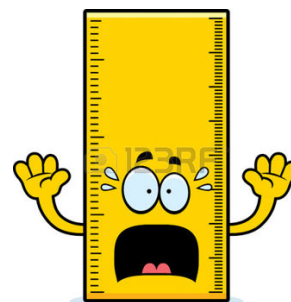
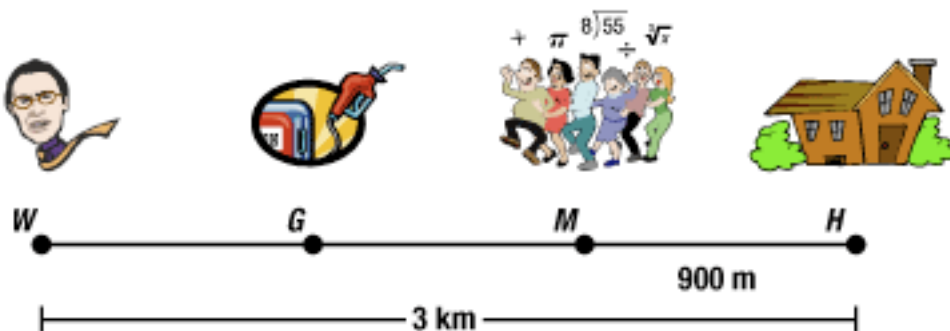
14. E is between D and F . Find DF .



1-2 Measuring and Constructing Segments: (p 17) 11-15.

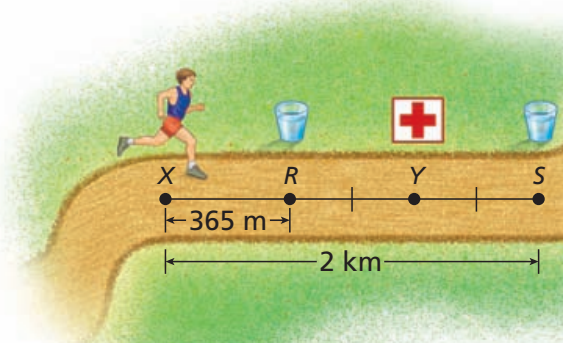
15. What is a midpoint?

Video Example 4: The distance from Dr. Burger's home to the the math party is 900 m. The gas station is located at the midpoint between the math party and where Dr. Burger works. The distance from where Dr. Burger works to his home is 3 km. How far is the gas station from Dr. Burger's home?



4 Recreation Application

The map shows the route for a race. You are 365 m from drink station R and 2 km from drink station S . The first-aid station is located at the midpoint of the two drink stations. How far are you from the first-aid station?



Let your current location be X and the location of the first-aid station be Y .

$$XR + RS = XS$$

$$365 + RS = 2000$$

$$\begin{array}{r} - 365 \\ 365 + RS = 2000 \\ \hline \end{array}$$

$$RS = 1635$$

$$RY = 817.5$$

$$XY = XR + RY$$

$$= 365 + 817.5 = 1182.5 \text{ m}$$

You are 1182.5 m from the first-aid station.

Seg. Add. Post.

Substitute 365 for XR and 2000 for XS .

Subtract 365 from both sides.

Simplify.

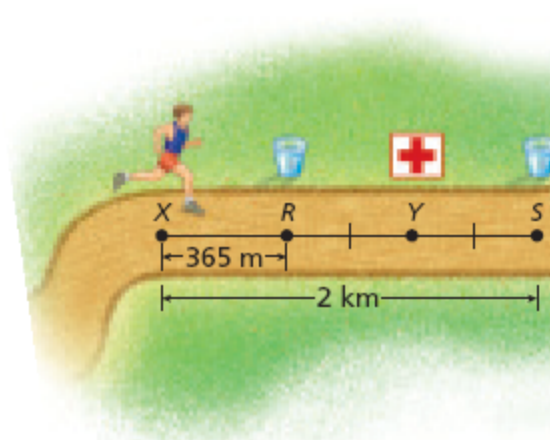
Y is the mdpt. of \overline{RS} , so $RY = \frac{1}{2}RS$.

Substitute 365 for XR and 817.5 for RY .

Example 4: The map shows the route for a race. You are at X , 6000 ft from the first checkpoint C . The second checkpoint D is located at the midpoint between C and the end of the race Y . The total race is 3 miles. How far apart are the 2 checkpoints?

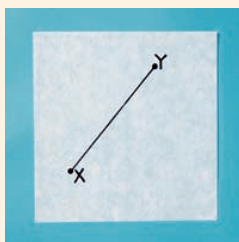


16. Guided Practice: You are 1182.5 m from the first-aid station. What is the distance to a drink station located at the midpoint between your current location and the first-aid station?



Construction Segment Bisector

1



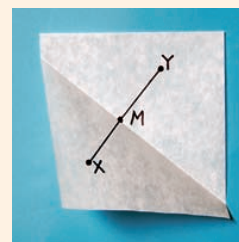
Draw \overline{XY} on a sheet of paper.

2



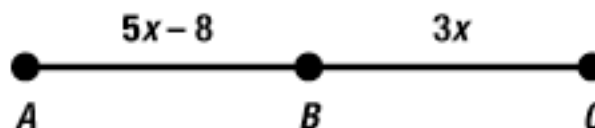
Fold the paper so that Y is on top of X.

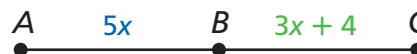
3



Unfold the paper. The line represented by the crease bisects \overline{XY} . Label the midpoint M .
 $XM = MY$

Video Example 5: B is the midpoint of \overline{AC} . Find AB, BC, & AC.



5 Using Midpoints to Find Lengths

B is the midpoint of \overline{AC} , $AB = 5x$, and $BC = 3x + 4$. Find AB , BC , and AC .

Step 1 Solve for x .

$$AB = BC$$

$$5x = 3x + 4$$

$$\begin{array}{r} -3x \\ \hline \end{array} \quad \begin{array}{r} -3x \\ \hline \end{array}$$

$$2x = 4$$

$$\frac{2x}{2} = \frac{4}{2}$$

$$x = 2$$

B is the mdpt. of \overline{AC} .

Substitute $5x$ for AB and $3x + 4$ for BC .

Subtract $3x$ from both sides.

Simplify.

Divide both sides by 2.

Simplify.

Step 2 Find AB , BC , and AC .

$$AB = 5x$$

$$= 5(2) = 10$$

$$BC = 3x + 4$$

$$= 3(2) + 4 = 10$$

$$AC = AB + BC$$

$$= 10 + 10 = 20$$



Example 5: D is the midpoint of \overline{EF} ,

$ED = 4x + 6$, and $DF = 7x - 9$. Find ED , DF , and EF .

17. Guided Practice. S is the midpoint of \overline{RT} , $RS = -2x$, and $ST = -3x - 2$. Find RS , ST , and RT .



1-2 Measuring and Constructing Segments: (p 17) 11-18, 19, 20, 22, 27, 30, 32, 34, 35.

